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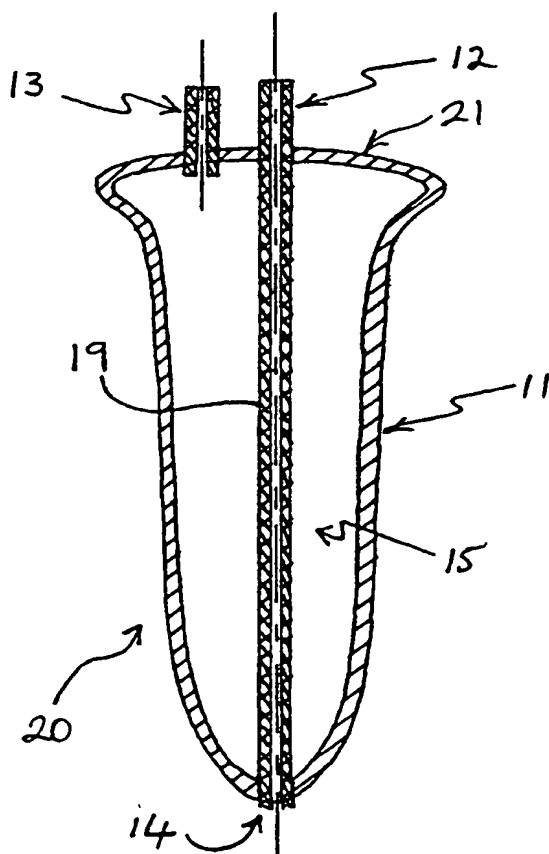
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(54) Title: MILKING MACHINE TESTING METHOD AND APPARATUS



(57) Abstract: The apparatus includes at least one artificial teat (20) comprising at least a collapsible chamber (15) having a first pressure testing port (13). The chamber (15) is collapsible under negative pressure exerted by a cup when the milking machine is operating. Analysis means is arranged to be coupled to the first pressure testing port (13) to measure the pressure within the collapsible chamber (15). A second pressure sensing port (12) may be provided to sense the pressure applied to the teat of the animal.

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MILKING MACHINE TESTING METHOD AND APPARATUS

Technical Field of the Invention

The present invention relates generally to the testing of milking machines and, in particular, to the improved testing of milking machines, for example used for milking
5 cows.

Background

Modern dairies are usually equipped with milking machines which, to a large extent, automate the process of milking cows, goats and the like. A milking machine used in such a dairy usually extracts milk from the animal by periodically squeezing the teats of
10 the animal in a manner which simulates hand-milking. The extracted milk is then directed to a central storage tank by means of tubing or similar conduit.

A key component of a milking machine used in a modern dairy is the teat-cup assembly. In a cow dairy, there are four teat-cup assemblies per milking stand, each teat-cup assembly being attached to a different teat on the cow's udder. Fig. 1 illustrates a
15 typical teat-cup assembly in cross-section and manner in which it is attached to the teat of the animal. The teat 1 enters a hole in the top of a rubber liner 3 which is fitted into a rigid plastic or stainless-steel cup 2 (shown in phantom). A volume 7 under the teat 1 is held at a relatively constant vacuum to enable milk entering the liner 3 to be transported to a milk storage tank by tubing 5. Milk is extracted from the teat 1 by alternatively
20 applying, then releasing, pressure to the wall of the teat 1 by introducing a pulsed vacuum supply to a pulsation chamber 6 via a short pulse tube 4.

The pulsed-vacuum supply is generated by a pulsator (not shown), which is essentially a two-way valve which connects the pulse tube 4 (and hence the pulsation chamber 6) to either a constant vacuum or air at atmospheric pressure. The pressure
25 applied to the teat 1 is directly controlled by the differential pressure across the liner wall 3. Since the volume 7 located underneath the teat 1 is held at a constant vacuum, therefore when a vacuum is applied to the pulsation chamber 6 the differential pressure across the liner wall 3 is zero and the teat 1 is relaxed. When the pulsation chamber 6 changes state, air at atmospheric pressure is admitted to the pulsation chamber 6. This
30 causes the liner wall 3 to collapse over the teat 1, and apply pressure to the teat wall, forcing milk to be expressed from the teat 1.

Pressure waveform parameters such as frequency, duty cycle, rate of change and magnitude, as applied to the pulsation chamber 6 are critical to correct operation of the

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dairy and health of the cow. Incorrect parameters can cause a number of problems including teat health deterioration, prolonged milking times, and cross-infection of cow teats, to name but a few. It is therefore necessary to periodically check that the milking machine operates with the desired pressure waveform parameters.

5 It is the role of a milking machine technician to measure the parameters of the pressure waveform found in the pulsation chamber 6. The measurements are then compared to the parameter values specified for the particular machine. Any discrepancy between the measurements and the specified parameter values may be caused by incorrect adjustment of the machine, or equipment faults for example. Presently, measurement of
10 the pulsation chamber pressure waveform requires the technician to fit blank 'test plugs' to each liner 3, then disconnect the rubber hose connecting the short pulse tube 4 to the pulsator from the cup 2. A 'T-shaped' piece of tubing is then fitted to the short pulse tube 4. The rubber hose from the pulsator is then connected to the 'T-shaped' piece of tubing along with the rubber hose from the analysis instrument or pulsation tester. This testing
15 technique is illustrated in Fig. 2 which shows a pulsation tester 8 being attached to the cup 2 by means of hose 9. Hose 10 connects to the pulsator. The milking machine is then started so as to simulate the normal milking operation. The pressure applied to the pulsation chamber 6 is also made available to the analysis instrument or pulsation tester. The analysis instrument or pulsation tester analyses this pressure over time and calculates
20 the parameters of the pressure waveform.

 It will be appreciated that the current method of pulsation testing via disconnecting or reconnecting rubber tubing is time consuming, strenuous and causes additional wear to the milking machine's components. In some cases a syringe needle is used to enter the short pulse tube 4 and connect the analysis instrument on pulsation tester
25 to the pulsation chamber 6. This method of testing also has disadvantages in that a large needle can damage the tubing, whereas a small needle can introduce a restriction into the air flow to the pulsation tester, thus causing incorrect readings.

Summary of the Invention

 It is an object of the present invention to substantially overcome, or at least
30 ameliorate, one or more of the deficiencies of the prior art.

 According to a first aspect of the present disclosure, there is provided apparatus for determining at least the pulsation characteristics of a milking machine, the machine

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having at least one cup into which a teat of a milking animal is insertable, the apparatus comprising:

at least one artificial teat insertable into the one cup, the artificial teat comprising at least a collapsible chamber having a (first) pressure testing port, the chamber being
5 collapsible under negative pressure exerted by the cup when operating; and

analysis means arranged to be coupled to the (first) pressure testing port to measure the pressure within the collapsible chamber.

Preferably the artificial teat further comprises a second pressure testing port configured for sampling a pressure within the cup at a tip of the artificial teat, and the
10 analysis means is configured for coupling to the second port to measure the tip pressure.

Advantageously the artificial teat comprises a non-porous flexible wall shaped and sized like a natural teat and forming the chamber, and a first tube extending through the wall into the chamber to form the first pressure testing port.

Preferably the artificial teat further comprises a second tube extending
15 therethrough to protrude from the tip at one end thereof and forming the second port at the other end thereof.

In accordance with another aspect of the present disclosure there is provided an artificial teat comprising:

a wall defining a substantially hollow collapsible chamber, and shaped to form a
20 base and an apex;

a first tubing means hermetically sealed to the wall and extending through the chamber between the base and the apex; and

a second tubing means fluidly coupling the chamber to an exterior of the wall.

In accordance with another aspect of the present disclosure there is provided an
25 artificial teat comprising:

a wall defining a collapsible chamber, the wall being substantially conical shape with a base and an apex;

a first tubing means hermetically sealed against the wall and fluidly coupling the chamber to an exterior of the wall.

30 In accordance with another aspect of the present disclosure there is provided a method of determining the pulsation and vacuum characteristics of a milking machine, the method comprising the steps of:

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(a) inserting an artificial teat according to one of the above aspects into a milking cup of the machine; and

(b) monitoring pressures within the chamber and beneath the artificial teat by coupling pressure transducer means to each of the first and second tubing respectively.

5

Brief Description of the Drawing

At least one preferred embodiment of the present invention will now be described with reference to the drawings, in which:

Fig. 1 depicts the attachment of a prior art teat-cup assembly to an animal teat;

Fig. 2 schematically depicts the prior art technique of measuring the pressure applied to the pulsation chamber of a teat-cup assembly;

Fig. 3 illustrates a first arrangement of an artificial teat;

Fig. 4 shows a cross-sectional view of the artificial teat depicted in Fig. 3;

Fig. 5 shows a top of the artificial teat depicted in Fig. 3;

Fig. 6 illustrates the insertion of the artificial teat of Fig. 3 into a teat-cup assembly;

Fig. 7 schematically depicts the method of measuring the pressure in the collapsible chamber of the artificial teat of Fig. 3;

Fig. 8 illustrates a second arrangement of an artificial teat;

Fig. 9 shows a cross-sectional view of the artificial teat of Fig. 8;

Fig. 10 shows a top of the artificial teat of Fig. 8;

Fig. 11 depicts the insertion of the artificial teat of Fig. 8 into a teat-cup assembly;

Fig. 12 schematically depicts the method of measuring the pressure in the artificial teat depicted in Fig. 8;

Fig. 13 graphically depicts the pulsation chamber pressure waveform as well as the collapsible chamber pressure waveform;

Fig. 14 graphically depicts the pulsation chamber pressure waveform with some of the required parameters indicated; and

Fig. 15 is a flow diagram of a software processing of the waveform of Fig. 13.

30

Detailed Description Including Best Mode

Figs. 3, 4 and 5 show an artificial teat 20 constructed and sized to emulate the teat of a milking dairy cow. The artificial teat 20 is formed of a semi-conically-shaped wall 11 moulded about a rigid elongate vacuum sensing tube 19 which, as best seen in

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Fig. 4, is centrally located along a longitudinal axis of the teat 20. The wall 11 is moulded and forms at its upper end a base 19 supported by the tube 19. The wall 11 is preferably formed of a non-porous and flexible material such as rubber or silicone. The wall 11 is closed to define a collapsible chamber 15 therewithin and surrounding the tubing 19 at all locations excepting its peripheral ends 12 and 14. The tubing 19 extends the entire length of the artificial teat 20 to protrude at the base so that the open end 14, representing the tip of the teat 20, may be subjected to a relatively constant vacuum pressure applied by the milking machine. A chamber testing tube 13 is also provided to allow access from the exterior of the wall into the chamber 15 for the measurement of the pressure therewithin. Each of the tubing 13 and 19 permit fluid coupling about the teat 20 thereby permitting fluid pressure sensing.

Fig. 6 shows the artificial teat 20 inserted into a teat cup 2 of a milking machine. Due to its size and configuration, the artificial teat 20 may be subjected to the same vacuum pressures to which a natural teat is subjected during the milking process. As seen, the opening 14 of the vacuum sensing tube 19 is exposed to pressure applied via the milk outlet tube 5 whereas the artificial teat wall 11 is subjected to pressure applied by the rubber liner 3 exerted by the pulse vacuum supply applied via the tube connection 4.

Fig. 7 illustrates how the artificial teat 20 may be used for the testing of the milking machines and appliances. As schematically depicted in Fig. 7, an analysis instrument or pulsation tester 16 is coupled to the artificial teat 20 through tubing 17 and 18 being coupled to the tubing 12 and 13 respectively. The pulsation tester 16 typically includes pressure transducers configured to sense the pressure applied in each of the tubing 17 and 18 and as a consequence, the pressure is applied within the collapsible chamber 15 and at the opening 14 of the artificial teat 20. Specifically, the transduced pressures may be compared to determine the differential pressure as supplied by the milking apparatus across the teat and thereby whether or not the milking apparatus is operating within its design limits.

In this fashion, as opposed to performing the prior art testing method of Fig. 2 which requires disconnection of vacuum connections to the milking cup 2, the artificial teat 20 permits direct insertion into the milking cup 2 for direct sensing the pressures applied by the cup during normal milking operations. In this fashion, and returning to Fig. 6, the periodic pressure applied to the artificial teat 20 by the rubber lining 3 has the effect of alternately compressing and decompressing air present within the collapsible

chamber 15 thus changing the pressure sensed by way of the tubing 13. Further, the constant vacuum within the volume 7 defined by the teat cup is presented to the pulsation tester 16 via the tubing 19 and its coupling to the tubing 17.

The tube outlet 13 coupled to the collapsible chamber 15 produces a positive
5 pressure waveform which is proportional to the load applied to the teat. Fig. 13 shows a typical pulsation chamber waveform W1 and a waveform W2 obtained from the collapsible chamber. It is observed from Fig. 13 that the base unit of pressure is one atmosphere (101.325 kPa) and that the pulsation chamber waveform W1 represents a decrease in pressure (a vacuum) whereas the collapsible chamber waveform is a positive
10 pressure which is seen to have an offset component (P_{offset}) and variations from the offset arising from the application of the pulsation pressure.

As can be seen, the pulsation pressure waveform W1 is based on the zero vacuum atmospheric pressure line (V_{min}) that rises to a maximum vacuum applied which is typically that of a vacuum supply line. The collapsible chamber waveform W2 is
15 positive going and is much lower in magnitude and is not based on the zero pressure line. Both the amplitude and minimum pressure values for the collapsible chamber waveform may vary between installations depending on many factors including the length of the sensing tube used to connect to the pulsation tester, the initial pressure in the chamber, and the compression of the test teat when inserted into the rubber liner 3.

20 Fig. 14 illustrates a pulsation chamber waveform derived from the prior art hose disconnection method of Fig. 2 together with various important points (A, B, C and D) from which readings are normally calculated for analysis of the collapsible chamber waveform.

Analysis of the waveform requires the following parameters:

- 25
1. ratios of A, B, C and D expressed as either a percentage of the total period, or in milliseconds;
 2. the rate of the waveform (frequency) expressed in cycles per minute;
 3. time on atmospheric pressure (zero) where the D ratio is expressed in milliseconds; and
 - 30 4. the maximum vacuum in either kilopascals or inches of mercury (inHg).

Software is preferably used to analyse the collapsible chamber waveform and must adjust the collapsible chamber waveform so that it closely resembles a typical pulsation chamber waveform. Fig. 15 shows a preferred software method 30 which

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includes a first step 31 of removing minimum pressure offset value to produce a zero reference pressure value. At step 32, which follows, the result is inverted and at step 33 this is amplified so that the maximum vacuum is that of the below teat pressure.

The same analysis software that is currently used in prior art arrangements may then be applied to the waveform, this including step 34 which finds a 4 kPa point below the maximum threshold. Step 35 then finds an access points where waveform crosses the thresholds established in step 34. Step 36 then calculates the period of the waveform using the graph crossing points of step 35 and step 37 determines the ratios of the various crossing points as illustrated. Step 38 then calculates the rate of pressure application in cycles and then step 39 displays the results to the milk machine tester. The results are displayed in a manner consistent with the traditional hose disconnection method.

Figs. 8, 9 and 10 illustrate an alternative arrangement where an artificial teat 40 is provided that operates in such a manner that the amplitude of the waveform is not detected. This reduces the cost of the tester to the farmer who may wish to purchase such equipment. As seen, the artificial teat 40 is formed in a manner similar to the previous embodiment excepting that the vacuum sensing tube 19 is omitted. In its place, the space otherwise occupied by the vacuum sensing tube 19 is positioned a support rod 41 integrally formed with, and of the same material as, the wall 11 of the artificial teat 40. Fig. 11 illustrates how the artificial teat 40 may be used for testing with the teat cup 2 and Fig. 12 illustrates how the artificial teat 40 is coupled directly to a testing apparatus 16. In such applications, the amplification stage (step 33 of Fig. 15) is configured to increase the height of the waveform to a fixed reference value (eg. 50 kPa) and the maximum vacuum level would not be displayed.

The artificial teat of the described arrangements may be manufactured in a variety of configurations each tailored to the specific parameters required to be measured. The significant advantages of the artificial teat is that it obviates the need for disconnection of any of the tubing normally coupled to the milking cup thus greatly improves the rate at which testing of the milking appliances can be made. As the device is inserted into the teat cup, along with a blank test plug into the remaining three cups to prevent air leakage as is done currently, there is no requirement to remove hoses, and little fatigue on the operator and no damage to milking equipment. The results obtained from the testing utilising the artificial teat are also more representative of the forces being

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applied to the teat, rather than through the indirect measurement technique of pulsation chamber waveforms.

Industrial Applicability

It is apparent from the above that the arrangements disclosed are applicable to
5 industries, such as the dairy industry, where the correct operation of milking machines is important.

The foregoing describes only some embodiments of the present invention, and modifications and/or changes can be made thereto without departing from the scope and spirit of the present invention.

10 In the context of this specification, the word "comprising" means "including principally but not necessarily solely" or "having" or "including" and not "consisting only of". Variations of the word comprising, such as "comprise" and "comprises" have corresponding meanings.

CLAIMS:

1. Apparatus for determining at least the pulsation characteristics of a milking machine, said machine having at least one cup into which a teat of a milking animal is insertable, said apparatus comprising:
5 at least one artificial teat insertable into said one cup, said artificial teat comprising at least a collapsible chamber having a (first) pressure testing port, said chamber being collapsible under negative pressure exerted by said cup when operating; and
10 analysis means arranged to be coupled to said (first) pressure testing port to measure the pressure within said collapsible chamber.
2. Apparatus as claimed in claim 1, wherein said artificial teat further comprises a second pressure testing port configured for sampling a pressure within said cup at a tip of
15 said artificial teat, and said analysis means is configured for coupling to said second port to measure said tip pressure.
3. Apparatus as claimed in claim 1 or 2, wherein said artificial teat comprises a non-porous flexible wall shaped and sized like a natural teat and forming said chamber,
20 and a first tube extending through said wall into said chamber to form said first pressure testing port.
4. Apparatus as claimed in claim 3, wherein said artificial teat further comprises a second tube extending therethrough to protrude from said tip at one end thereof and
25 forming said second port at the other end thereof.
5. Apparatus as claimed in claim 4, wherein said artificial teat means comprises a moulded wall forming said collapsible chamber and being a hermetic sealed against said first and second tubing means.
30
6. Apparatus as claimed in claim 5, wherein said wall is constructed of rubber.
7. Apparatus as claimed in claim 5, wherein said wall is constructed of silicone.

8. Apparatus as claimed in any one of claims 1 to 7, wherein said analysis means is a pulsation tester.
- 5 9. A artificial teat comprising:
a wall defining a substantially hollow collapsible chamber, and shaped to form a base and an apex;
a first tubing means hermetically sealed to said wall and extending through said chamber between said base and said apex; and
10 a second tubing means fluidly coupling said chamber to an exterior of said wall.
10. An artificial teat comprising:
a wall defining a collapsible chamber, said wall being substantially conical shape with a base and an apex;
15 a first tubing means hermetically sealed against said wall and fluidly coupling said chamber to an exterior of said wall.
11. The artificial teat as claimed in claim 9 or 10, wherein said wall is constructed of rubber.
- 20 12. The artificial teat as claimed in claims 9 or 10, wherein said wall is constructed of silicone.
13. A method of determining the pulsation and vacuum characteristics of a milking machine, said method comprising the steps of:
25 (a) inserting an artificial teat according to claim 9 into a milking cup of said machine; and
(b) monitoring pressures within said chamber and beneath said artificial teat by coupling pressure transducer means to each of said first and second tubing
30 respectively.
14. An artificial teat substantially as described herein with reference to Figs. 3, 4 and 5, or Figs. 8, 9 and 10 of the drawings.

15. A method of monitoring the milking characteristics of a milking machine substantially as described herein with reference to any one of the embodiments as illustrated in Figs. 3 to 13 and 15 or the drawings.

AMENDED CLAIMS

[received by the International Bureau on 20 February 2001 (20.02.01);
original claims 1-15 replaced by new claims 1-14 (3 pages)]

1. Apparatus for determining at least the pulsation characteristics of a milking machine, said machine having at least one cup into which a teat of a milking animal is insertable, said apparatus comprising:
 - at least one artificial teat insertable into said one cup, said artificial teat comprising a non-porous flexible wall shaped and sized like a natural teat and forming a collapsible chamber, said chamber being collapsible under negative pressure exerted by said cup when operating;
 - a first tube extending through said wall into said chamber to form a (first) pressure testing port to detect a pressure within the chamber; and
 - analysis means arranged to be coupled to said (first) pressure testing port for measuring the pressure within said collapsible chamber.
2. Apparatus as claimed in claim 1, wherein said artificial teat further comprises a second pressure testing port configured for sampling a pressure within said cup at a tip of said artificial teat, and said analysis means is configured for coupling to said second port to measure said tip pressure.
3. Apparatus as claimed in claim 1, wherein said artificial teat further comprises a second tube extending therethrough to protrude from said tip at one end thereof and forming said second port at the other end thereof.
4. Apparatus as claimed in claim 3, wherein said artificial teat means comprises a moulded wall forming said collapsible chamber and being a hermetic sealed against said first and second tubing means.
5. Apparatus as claimed in claim 4, wherein said wall is constructed of rubber.
6. Apparatus as claimed in claim 4, wherein said wall is constructed of silicone.
7. Apparatus as claimed in any one of claims 1 to 6, wherein said analysis means is a pulsation tester.

8. An artificial teat comprising:
a wall defining a substantially hollow collapsible chamber, and shaped to form a base and an apex;
- 5 a first tubing means hermetically sealed to said wall and extending through said chamber between said base and said apex; and
a second tubing means fluidly coupling said chamber to an exterior of said wall.
9. An artificial teat comprising:
10 a wall defining a collapsible chamber, said wall being substantially conical shape with a base and an apex;
a first tubing means hermetically sealed against said wall and fluidly coupling said chamber to an exterior of said wall.
- 15 10. The artificial teat as claimed in claim 8 or 9, wherein said wall is constructed of rubber.
11. The artificial teat as claimed in claims 8 or 9, wherein said wall is constructed of silicone.
- 20 12. A method of determining the pulsation and vacuum characteristics of a milking machine, said method comprising the steps of:
(a) inserting an artificial teat according to claim 9 into a milking cup of said machine; and
25 (b) monitoring pressures within said chamber and beneath said artificial teat by coupling pressure transducer means to each of said first and second tubing respectively.
13. An artificial teat substantially as described herein with reference to Figs. 3, 4 and
30 5, or Figs. 8, 9 and 10 of the drawings.

14. A method of monitoring the milking characteristics of a milking machine substantially as described herein with reference to any one of the embodiments as illustrated in Figs. 3 to 13 and 15 or the drawings.

Statement Under Article 19(1).

The amended claims are characterised generally by an artificial teat having a non-porous flexible wall shaped in a manner so as to more accurately emulate a milking animal's teat. The flexible wall forms a collapsible chamber having a tube extending through the wall. In this way the artificial teat provides more accurate detection of the actual pressure applied to a milking animal's teat by a milking machine pulsation chamber.

SU 1625452 discloses a "teat simulator" comprising a flexible chamber having a feed channel for introducing a milk substitute into the chamber. In contrast, the flexible chamber claimed in the present application is provided with a first tube to enable connection of test equipment for measuring the pressure within a space defined by the flexible chamber. That space is void of any fluid and contains air.

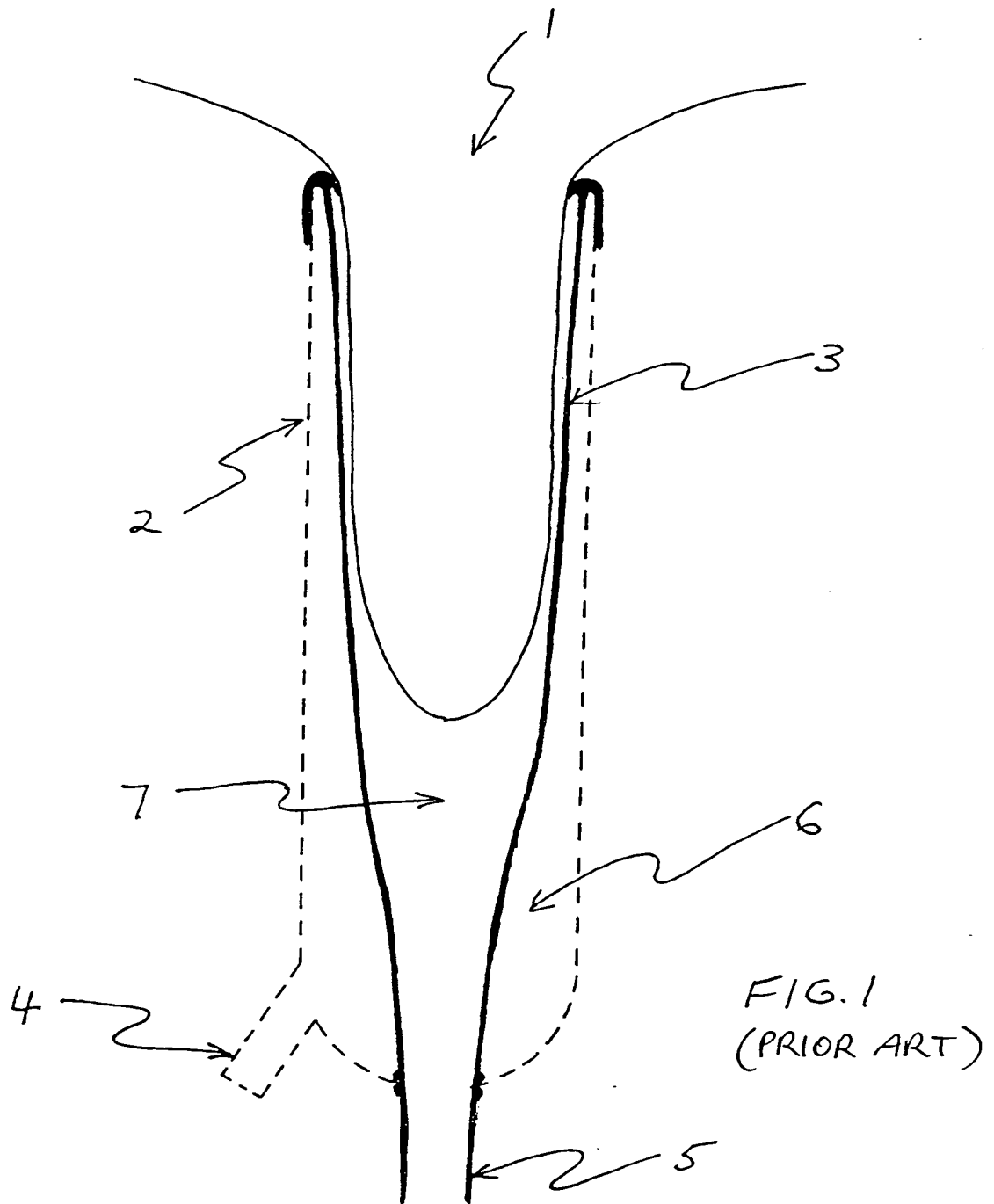
SU 1528399 discloses an artificial teat having a measuring chamber formed at a particular single location thereon. Whereas, the flexible chamber defined in the claims of the present application is formed as, and in particular, along the entire length of the artificial teat. Such an arrangement therefore more accurately emulates a milking animal's teat and thus, empirically, responds to the operation of the milking machine pulsation chamber in a more precise manner. In contrast, SU 1528399 only provides a localised pressure detection configuration which is far less representative of the actual pressure being applied to a milking animal's teat.

SU 1099906 discloses an artificial teat having a measuring chamber formed of two elliptically-shaped thin wall metal sections joined by elastic elements. The chamber itself is also located at a particular single point on the artificial teat. In contrast, the flexible chamber of the present application is formed as, and therefore, along the entire length of the artificial teat.

SU 897180 discloses a device intended for testing the teat cup rigidity of a milking machine. This is a different device to that claimed in the present application.

SU 1355187 discloses an artificial teat comprising a hollow housing which forms the main body of the device. In contrast to the claims of the present application, SU 1355187 has no provision to enable connection of test equipment for measuring the pressure within this housing.

SU 1412671 discloses "a fault finding device used in the detection of leaks in the milking machine teat cup rubber". This device does not provide a facility whereby measurement can be made of the pulsation chamber pressure applied to a milking animal's teat.



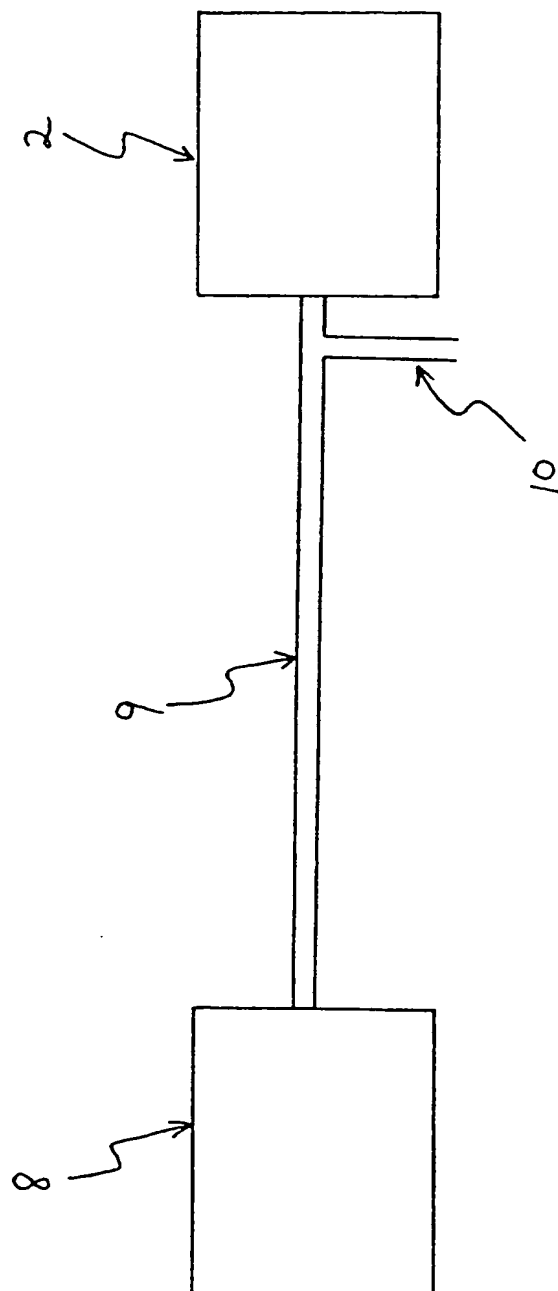
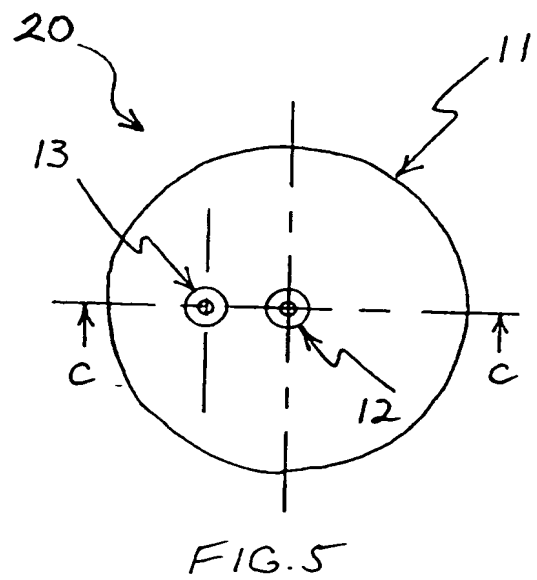
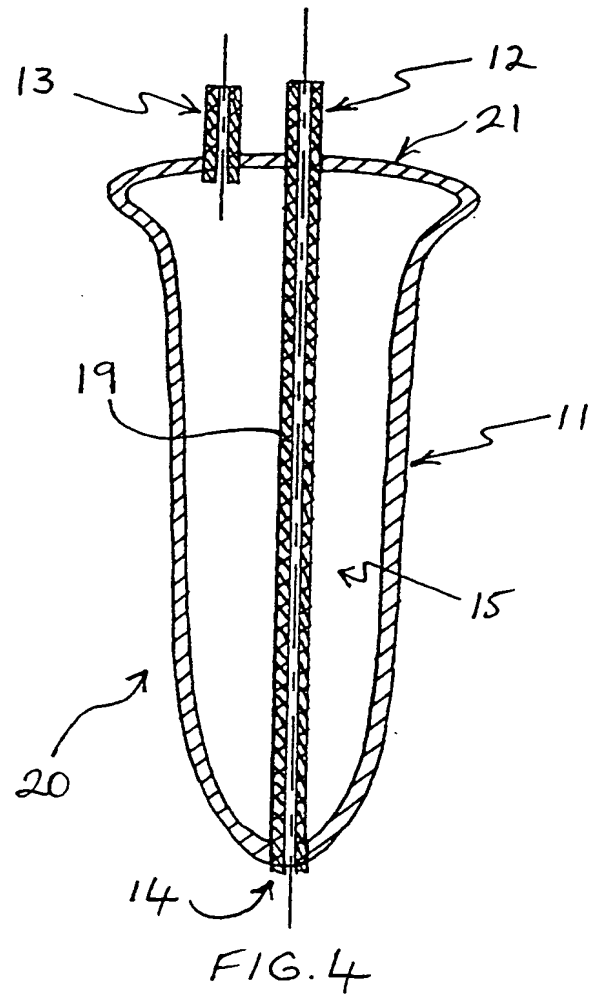
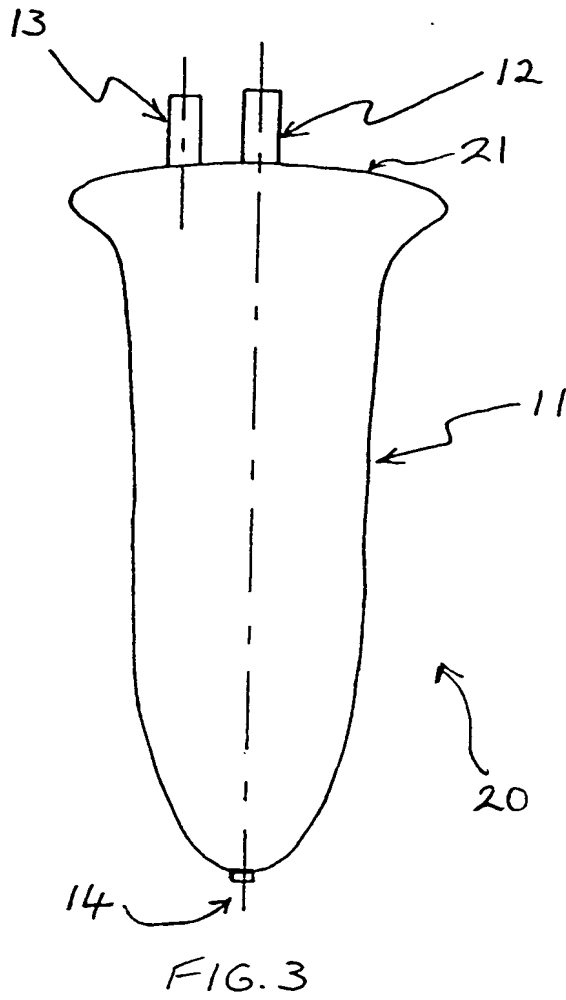
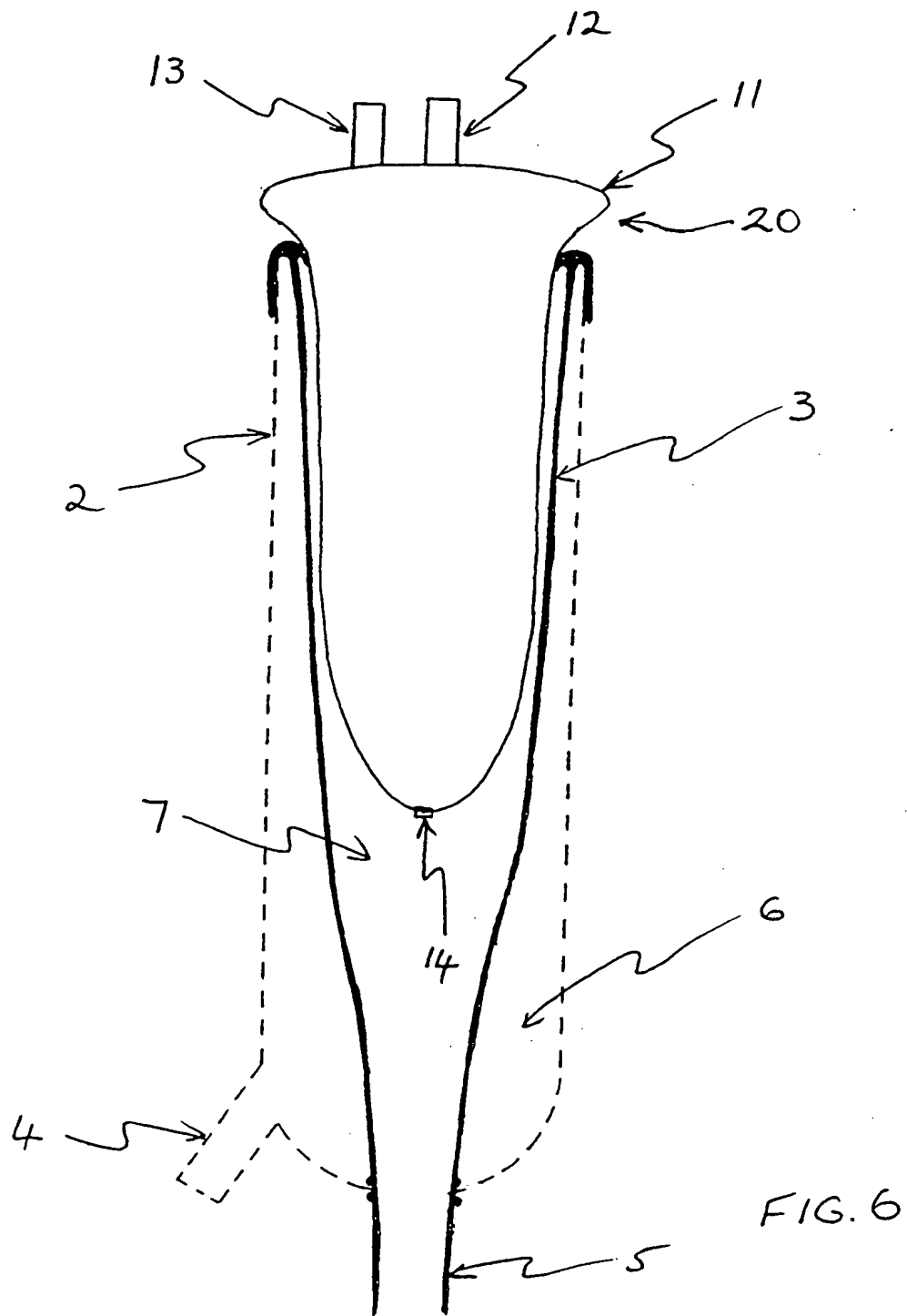


FIG. 2
(PRIOR ART)





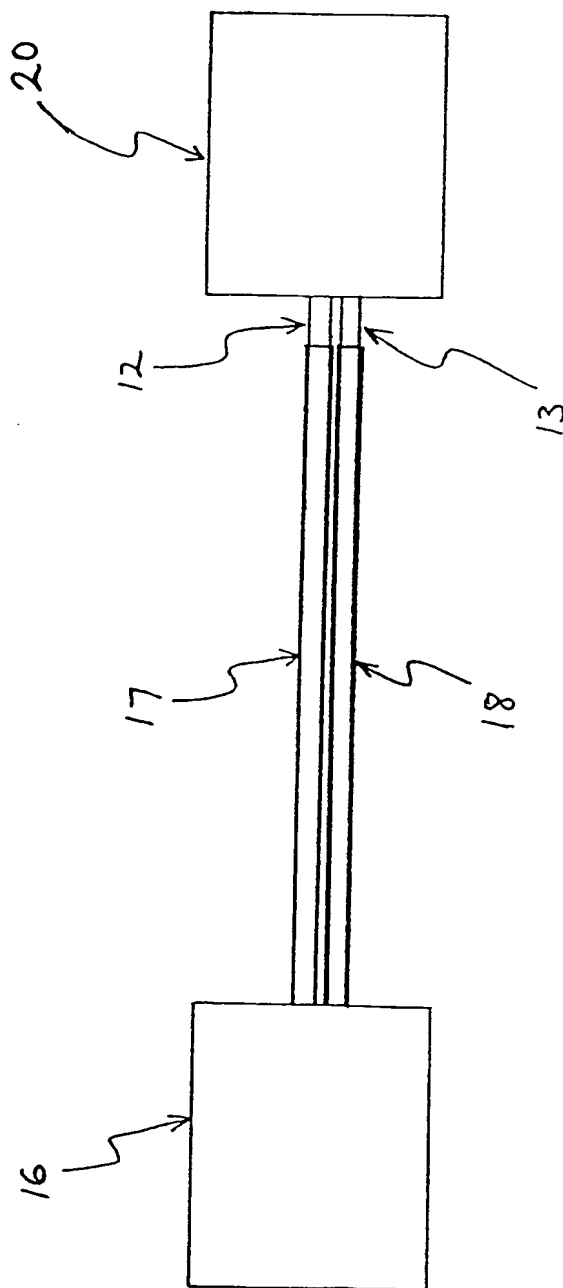


FIG. 7

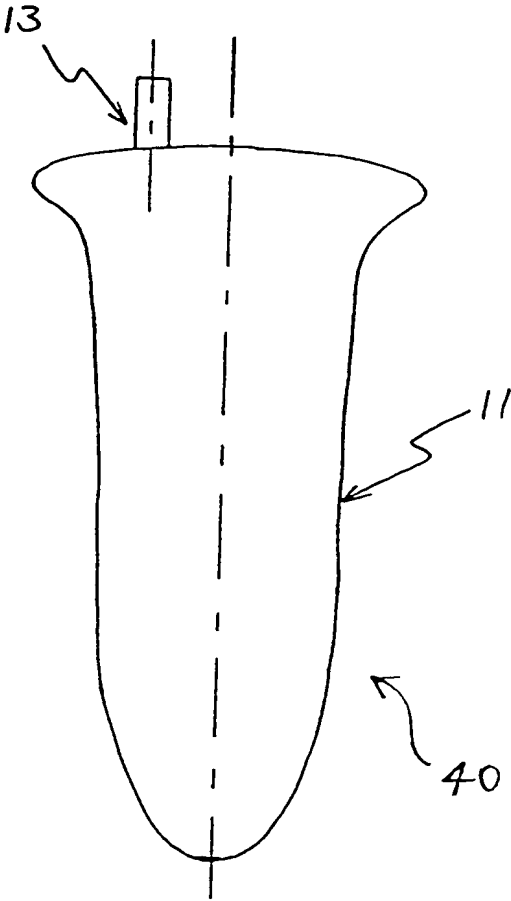


FIG. 8

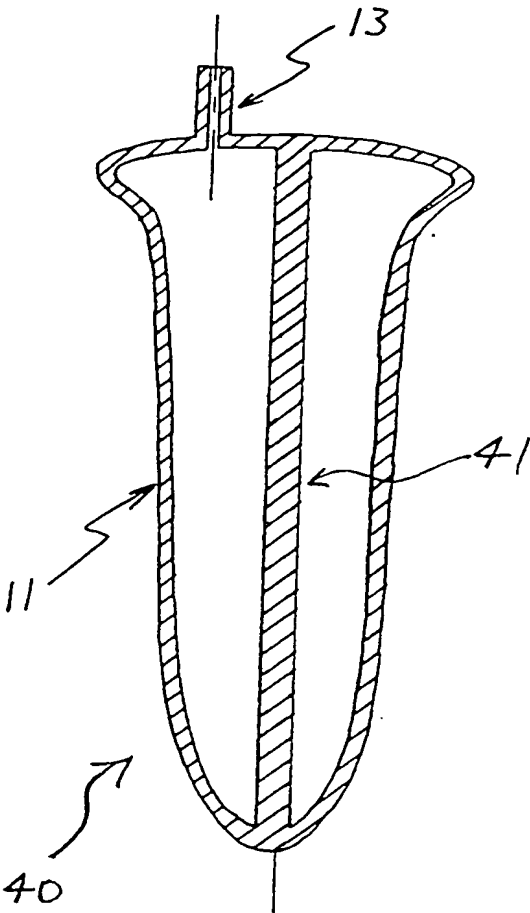


FIG. 9

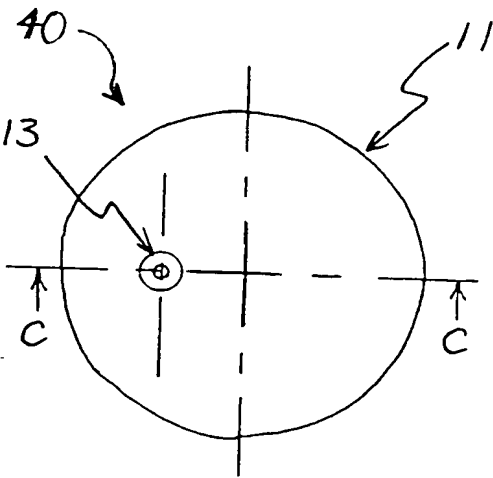
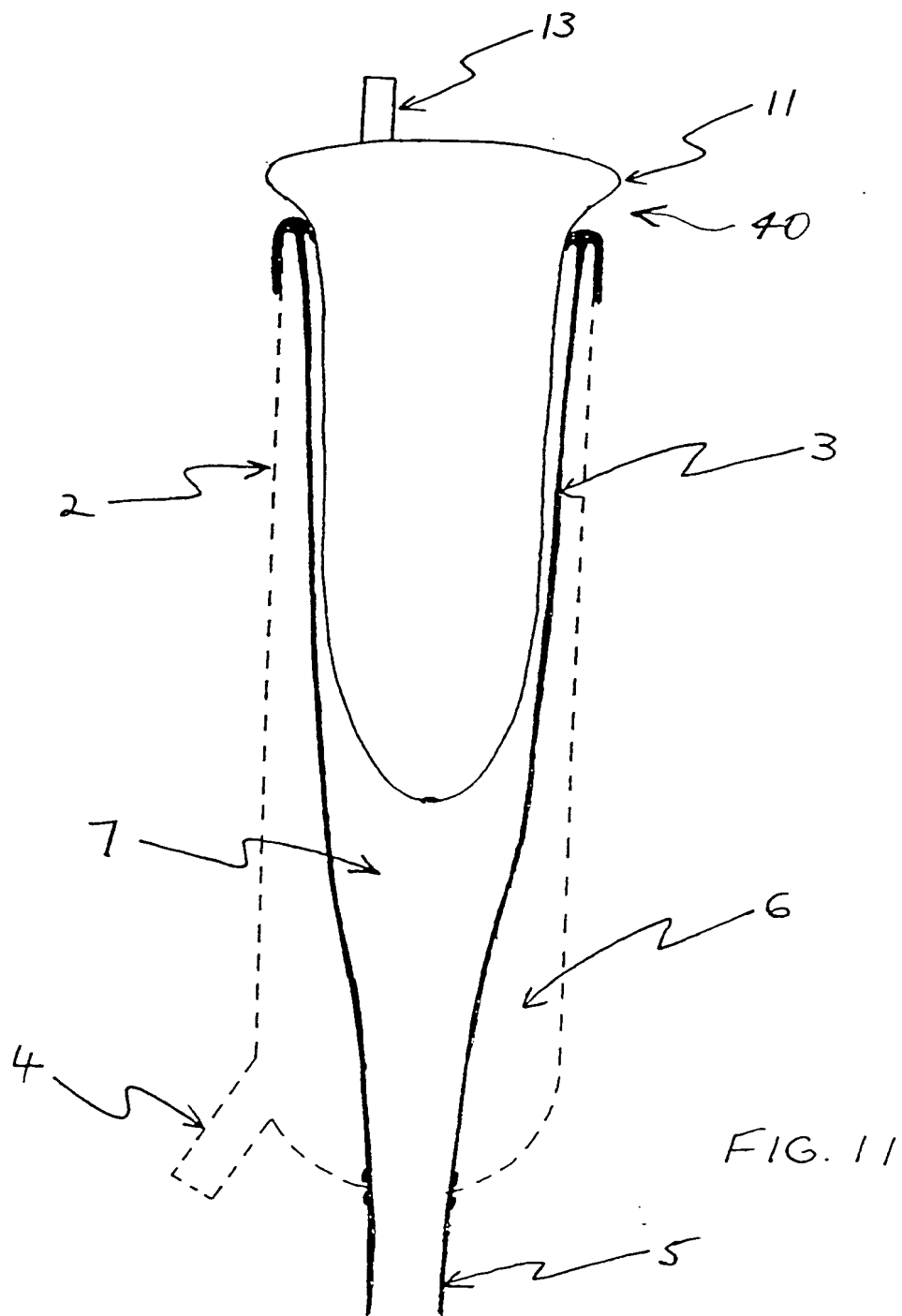


FIG. 10



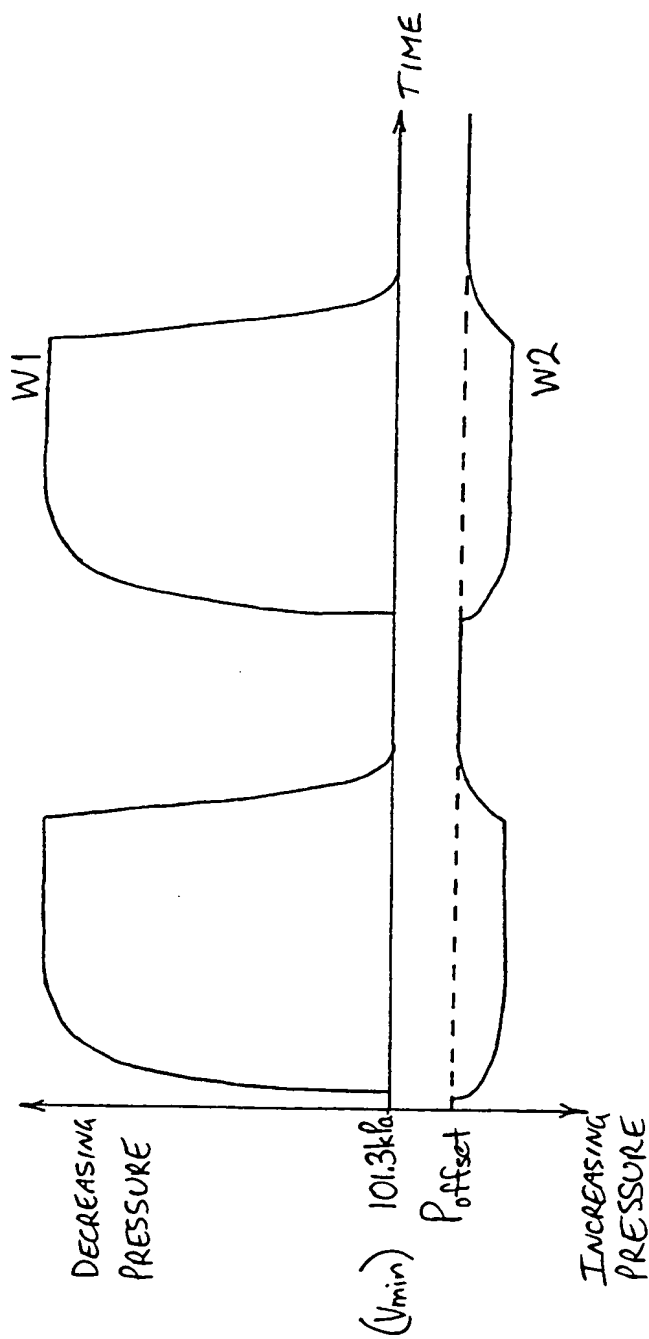


FIG. 13

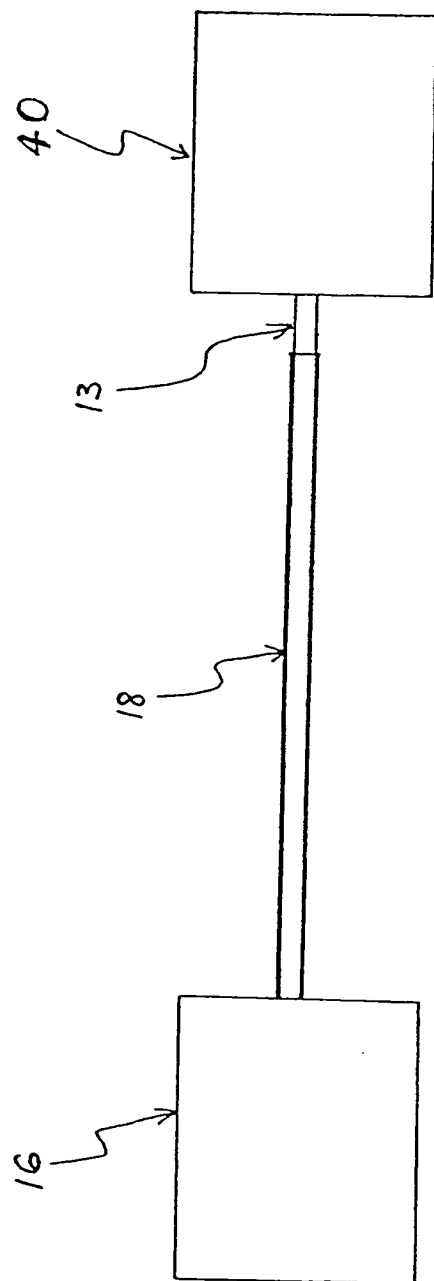


FIG. 12

FIG. 12

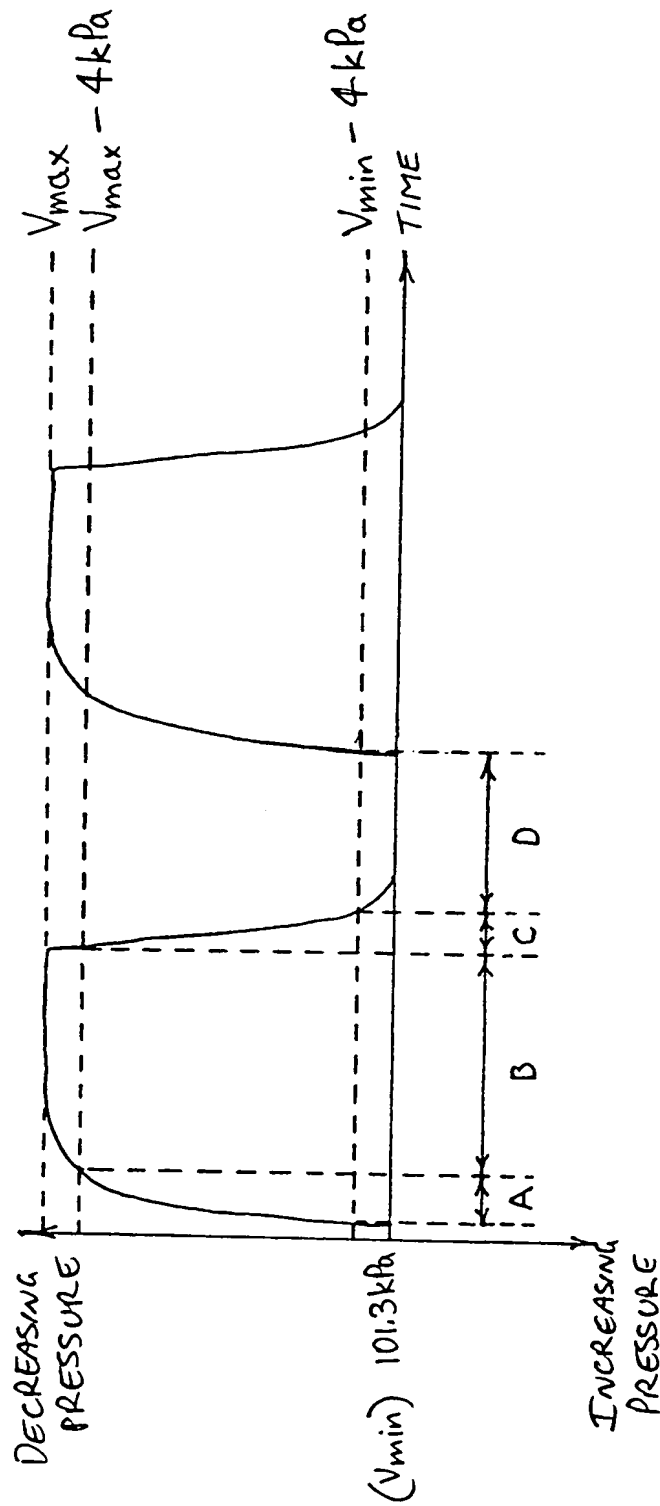


FIG. 14
(PRIOR ART)

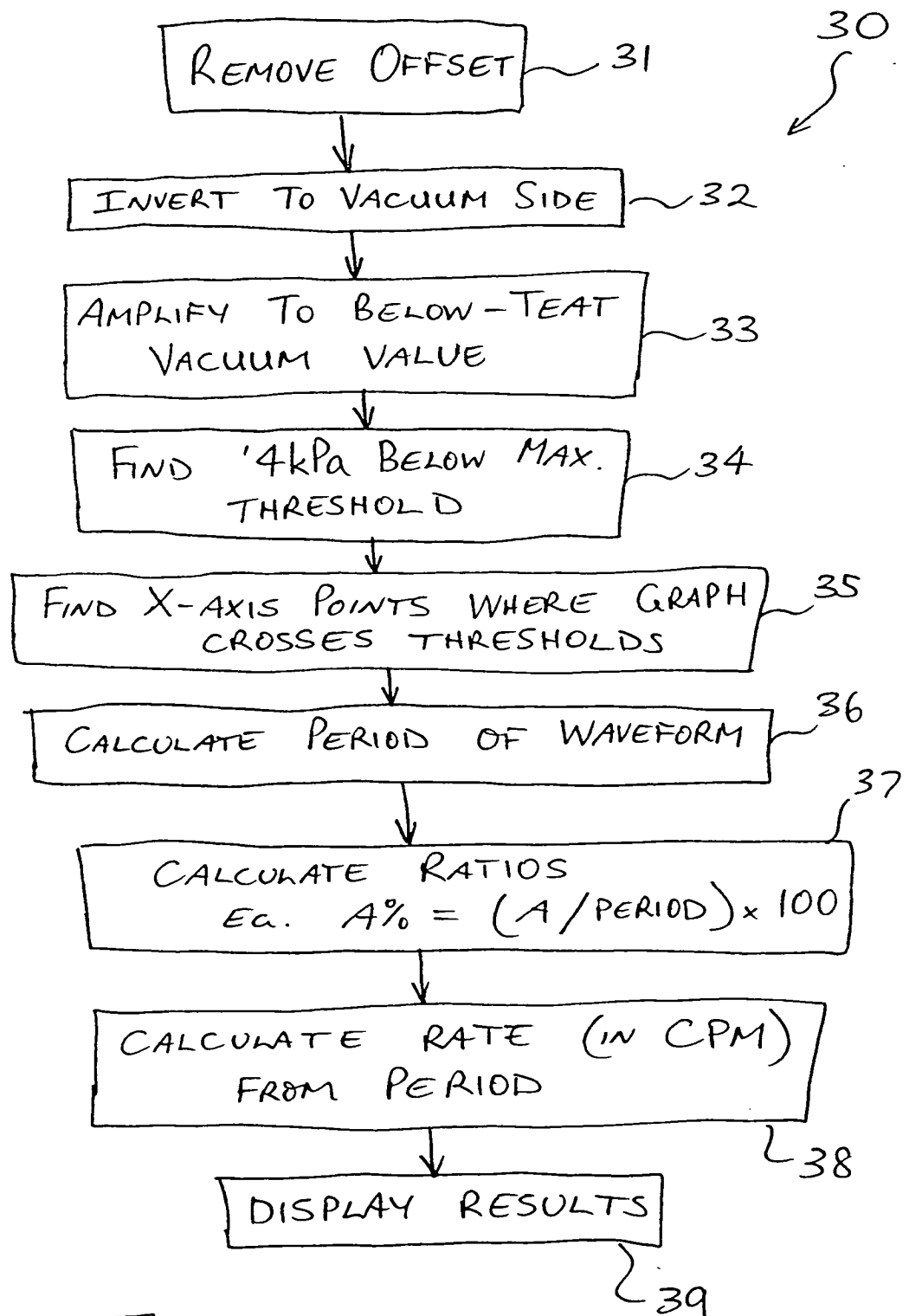


FIG. 15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 00/01300

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl⁷: A01J 7/00, 5/007

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC A01J 7/00, 5/007

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
DWPI: 1 A01J 7/- and teat etc. and test etc
2 A01J 5/- and artificial and teat

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Derwent Abstract Accession No. 91-315837/43 Class P13 SU 1625452 A (ORENBURG AGRIC INST) 7 February 1991 ✓ Abstract	1-15
X	Derwent Abstract Accession No. A2032 J/47 Class P13 SU897180 A (BLAGOVESHCHENSK AGR) 16 January 1982 ✓ Abstract	1-15
X	Derwent Abstract Accession No. 85-036744/08 Class P13 SU 1099906 A (KUBAN AGRIC INST) 30 June 1984 ✓ Abstract	1-15

☒ Further documents are listed in the continuation of Box C

☐ See patent family annex

<p>* Special categories of cited documents:</p>		
"A"	Document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	
"P"	document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search
10 November 2000

Date of mailing of the international search report

23 NOV 2000

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 00/01300

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Derwent Abstract Accession No. 88-167488/24 Class P13 SU 1355187 A (KUBAN AGRIC INST) 30 November 1987 Abstract	1-15
X	Derwent Abstract Accession No. 89-038431/05 Class P13 SU 1412671 A (MORDOVIA UNIV) 30 July 1988 Abstract	1-15
X	Derwent Abstract Accession No. 90-215129/28 Class P13 SU 1528399 A (KISH AGRIC INST) 15 December 1989 Abstract	1-15